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SECTION TABLE OF CONTENTS
DIVISION 02 - SITE CONSTRUCTION
SECTION 02536
SANITARY SEWERAGE SYSTEMS
06/04

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DRAWINGS
- 1.4 EXISTING CONDITIONS

PART 2 PRODUCTS

- 2.1 BRICK FOR MANHOLES
- 2.2 CEMENT MORTAR
- 2.3 CONCRETE AGGREGATES
- 2.4 RUBBER GASKETS
- 2.5 PIPE
- 2.6 PORTLAND CEMENT
- 2.7 FRAMES AND COVERS
- 2.8 JOINTING
- 2.9 CONCRETE CRADLE AND ENCASEMENT
- 2.10 MANHOLES
 - 2.10.1 Construction
 - 2.10.1.1 Invert Channels
 - 2.10.1.2 Concrete
 - 2.10.1.3 Ladders
 - 2.10.1.4 Jointing and Plastering
- 2.11 REPORTS

PART 3 EXECUTION

- 3.1 LOCATION
- 3.2 PIPE LAYING
- 3.3 INFILTRATION AND EXFILTRATION
- 3.4 WYE BRANCHES
- 3.5 CONNECTIONS TO EXISTING MANHOLES
- 3.6 ACCEPTANCE

-- End of Section Table of Contents --

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SECTION 02536

SANITARY SEWERAGE SYSTEMS
06/04

NOTE: Delete, revise, or add to the text in this
section to cover project requirements. Notes are
for designer information and will not appear in the
final project specification.

This section covers gravity sewers and manholes,
complete.

Associated work found in other sections includes
excavation and backfilling.

Drawings must indicate dimensions, locations,
elevations, and depths.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be
manually edited except to add new references.
References not used in the text will automatically
be deleted from this section of the project
specification.

The publications listed below form a part of this section to the extent
referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 306 (2000) Drainage Structure Castings

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A 48/A 48M (2003) Standard Specification for Gray
Iron Castings

ASTM A 74 (2004) Standard Specification for Cast

Iron Soil Pipe and Fittings

ASTM C 14	(2003) Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(2003) Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 150	(2002ae1) Standard Specification for Portland Cement
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 425	(2002) Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(2003) Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(2003) Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 564	(2003a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 62	(2001) Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)
ASTM C 700	(2002) Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 76	(2003) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(2003) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM D 1869	(1995; R 2003) Rubber Rings for Asbestos-Cement Pipe
ASTM D 2750	(1993) Acrylonitrile-Butadiene-Styrene (ABS) Plastics Utilities Conduit and Fittings
ASTM D 3034	(2000) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Records of Existing Conditions shall be submitted by the Contractor prior to construction.

SD-02 Shop Drawings

The following shall be submitted by the Contractor in accordance with paragraph entitled, "Drawings," of this section.

Installation Drawings
As-Built Drawings

SD-06 Test Reports

Reports for the following shall be submitted in accordance with paragraph entitled, "Reports," of this section.

Test Reports
Inspection Reports

SD-07 Certificates

Certificates of compliance for the following items shall be submitted in accordance with the applicable reference standards and description of this section:

Brick for Manholes
Concrete Aggregates
Portland Cement
Rubber Gaskets
Pipe
Frames and Covers

1.3 DRAWINGS

Installation Drawings shall be submitted showing complete detail, both plan and sideview details with proper layout dimension and elevations.

As-Built Drawings for the complete sanitary sewer system shall be submitted showing complete detail with all dimensions, both above and below grade.

1.4 EXISTING CONDITIONS

Existing Conditions shall be submitted after a thorough inspection of the area by the Contractor in the presence of the Contracting Officer. Details should include the condition of environment and other areas adjacent to site work. Copies of the record shall be submitted and the stated conditions before starting work shall be verified.

PART 2 PRODUCTS

2.1 BRICK FOR MANHOLES

**NOTE: When precast concrete manholes are to be
used, use local specifications.**

Brick shall conform to ASTM C 62, Grade SW.

2.2 CEMENT MORTAR

Mortar shall consist of 1 part portland cement and 2 parts fine sand with enough water to produce mortar of the proper consistency for the type of joint.

2.3 CONCRETE AGGREGATES

Aggregates shall conform to ASTM C 33.

2.4 RUBBER GASKETS

Rubber gaskets shall conform to ASTM C 443, ASTM C 443M, ASTM C 564, and ASTM D 1869.

2.5 PIPE

Pipe shall be as follows:

Vitrified clay pipe and fittings shall conform to ASTM C 700, standard strength, bell-and-spigot type. Joints shall be in accordance with ASTM C 425.

Concrete pipe and fittings shall conform to ASTM C 14 ASTM C 14M and shall be the bell-and-spigot type.

Cast iron soil pipe and fittings shall conform to ASTM A 74. Joint gaskets shall conform to ASTM C 564.

Polyvinylchloride (PVC) pipe and fittings shall conform to ASTM D 3034, Cell Classification 12454-B.

Acrylonitrile-butadiene-styrene (ABS) pipe and fittings shall be in accordance with ASTM D 2750.

2.6 PORTLAND CEMENT

Cement shall conform to ASTM C 150, Type [____].

2.7 FRAMES AND COVERS

Cast iron frames and covers shall be in accordance with AASHTO M 306.

Deviations in standard castings shall be acceptable only when prior approval has been granted. Frames and covers shall have a combined weight of not less than [400] [880] [_____] pounds kilogram and shall conform to ASTM A 48/A 48M.

The letter S at least [2] [50] [_____] inches millimeter high shall be stamped or cast into covers so as to be conspicuously visible.

2.8 JOINTING

Cement mortar shall not be used as a pipe-jointing material except for wye branches.

Pipe joints shall be sealed with:

[Factory molded plastic [in the annular space] [and] [on the spigot of the pipe]. Plastic will be acceptable only where used with clay pipe.]

[A rubber gasket configuration, as recommended by the pipe manufacturer for the particular type of pipe joint. Gaskets shall be installed to provide a tight fit. Rubber gaskets may be used with clay pipe, concrete pipe, cast iron soil pipe, PVC pipe, and ABS pipe.]

2.9 CONCRETE CRADLE AND ENCASEMENT

Pipe shall be [supported on a concrete cradle] [encased in concrete]. Concrete shall consist of 1 part portland cement, 2-1/2 parts sand, and 5 parts gravel, with enough water to produce a workable consistency.

2.10 MANHOLES

2.10.1 Construction

Manholes shall be constructed of brick, concrete, reinforced precast-concrete rings, precast-concrete rings, or precast-concrete segmental blocks, with cast iron frames and covers. Frames and covers shall be bolted down and as necessary. Frames and covers shall be set so that the top of the cover is 4-inches 100 millimeter higher than finished grade, where no pavement exists. Where pavement does exist, frames shall be flush with surface. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly.

2.10.1.1 Invert Channels

Invert channels shall [be formed directly in the concrete of the manhole base] [be built up with brick and mortar] [have half-tile laid in concrete] [be constructed by laying full-section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened]. Flooring of the manhole outside the channels shall be smooth and shall slope toward the channels, no less than [1] [25] [_____] inch per foot millimeter per 300 millimeter nor more than [2] [50] [_____] inches per foot millimeter per 300 millimeter. The free drop inside the manholes shall not

exceed [1 foot 6 inches] [460 millimeter] [_____] measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels. Drop manholes shall be constructed whenever the free drop would be greater than [1 foot 6 inches] [460 millimeter] [_____].

2.10.1.2 Concrete

Concrete used in manholes shall have a compressive strength of not less than [3,000] [21] [_____] pounds per square inch Megapascal after 28 calendar days and shall be composed of not less than six 7-1/2 bags of portland cement per cubic yard meter. Coarse aggregate shall be used in the greatest amount consistent with required workability. The foregoing requirements apply to concrete in precast rings, segmental blocks, and concrete poured in place. Concrete rings shall conform to ASTM C 76, ASTM C 76M, except that the length of sections may be shorter as conditions require. Wall thicknesses shall be not less than [4] [100] [_____] inches millimeter nor less than [1/12] [_____] the diameter of the manhole for either vertical walls or cone sections and shall be reinforced with not less than [0.12] [3] [_____] square inch millimeter of steel per foot 300 millimeter of height. Joints between precast rings shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Segmental blocks shall be at least [5] [130] [_____] inches millimeter but not more than [8] [200] [_____] inches millimeter in thickness, not less than [8] [200] [_____] inches millimeter in length, and of a shape that the joints can be effectively sealed and bonded with cement mortar.

2.10.1.3 Ladders

**NOTE: The following paragraph should be used only
when portable ladders are not feasible. It is
recommended that ladders not be installed (anchored
to walls) in manholes due to breakage, slipperiness,
and corrosion.**

When the depth from the top of the cover to the invert of the main sewer exceeds [12] [3700] [_____] feet, millimeter, manholes shall be provided with a straight steel ladder not less than [16] [400] [_____] inches millimeter in width with 3/4-inch 20 millimeter diameter rungs spaced 12 inches 300 millimeter on center. Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet 1830 millimeter apart vertically and installed to provide at least [6-1/2] [170] [_____] inches millimeter of toe space between the wall and the inside of the rungs. Stringers shall be 1/2- by 1-1/2-inch 15 by 40 millimeter steel bars. Ladder and inserts shall be galvanized after fabrication in accordance with ASTM A 123/A 123M. Wall along the line of the ladder shall be vertical its entire height.

2.10.1.4 Jointing and Plastering

Mortar for jointing and plastering shall consist of 1 part portland cement and 2 parts fine sand with enough water to produce a workable consistency. For brickwork, lime may be added to the mortar in the amount of not more than [25] [_____] percent of the volume of cement. Joints shall be completely filled, smooth, and free from surplus mortar on the inside of the manhole. Brick manholes shall be plastered with 1/2 inch 13 millimeter of mortar over the entire outside surface of the walls. Brick shall be

laid radially with every sixth course laid as a stretcher course.

2.11 REPORTS

Test Reports shall be submitted. Compaction and density test shall be in accordance with Section 02312 EXCAVATION, BACKFILLING, AND COMPACTING FOR UTILITIES.

Inspection Reports for daily activities during the installation of the sanitary system shall be submitted. Information in the report shall be detailed enough to describe location of work and amount (footage) laid.

PART 3 EXECUTION

3.1 LOCATION

Where the location of the sewer is not clearly defined by dimensions, the sewer shall be laid not closer than [10] [3000] [_____] feet millimeter horizontally to a water supply main or service line, except that where the bottom of the water pipe will be at least [12] [300] [_____] inches millimeter above the top of the sewer pipe, the horizontal spacing shall be a minimum of [6] [1830] [_____] feet. millimeter. Water lines shall be above sewage force mains.

Where gravity-flow sewers cross above waterlines, the sewer pipe for a distance of at least [10] [3000] [_____] feet millimeter each side of the crossing shall be cast iron, steel, or other acceptable pressure pipe and without joints closer horizontally than [3] [900] [_____] feet millimeter to the crossing, or the sewer pipe shall be fully encased in concrete. Thickness of the concrete, including that at the pipe joints, shall be not less than [4] [100] [_____] inches millimeter.

3.2 PIPE LAYING

Bottom of trench shall be shaped to give uniform circumferential support to the lower fourth of each pipe. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid true to line and grade in a manner to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. Interior of the sewer shall be cleared of superfluous materials at all times. Where cleaning after laying is difficult, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed. When the maximum width of the trench at the top of the pipe is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, such bedding as may be required to satisfactorily support the added load of the backfill. Trenches shall be kept free from water until the pipe-joining material has set. Pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. When work is not in progress, open ends of pipe and fittings shall be closed to prevent intrusion of foreign materials.

3.3 INFILTRATION AND EXFILTRATION

Leakage shall not exceed a rate of [200] [18.5] [_____] gallons per inch liter per millimeter of pipe diameter per mile kilometer per day of sewer for any section between successive manholes. When infiltration appears excessive, the amount of leakage shall be measured by a suitable weir or

other device. When the determination of infiltration is not practicable because of dry trench conditions, exfiltration tests shall be made by filling the sewer between successive manholes with water to the top of the outlet of the upper manholes. Amount of water required to maintain the pipe full for the required test period shall be measured and the rate of leakage determined. When leakage exceeds the maximum amount, an approved correction shall be made. Both measurement and correction shall be made at no additional cost to the Government.

3.4 WYE BRANCHES

Commercially manufactured wye branches shall be installed where sewer connections are necessary. Cutting into pipe for connections shall not be done except as approved. When conditions are such that the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete or supported on a concrete cradle as directed. Concrete required due to faulty construction methods or negligence of the Contractor shall be installed at no additional cost to the Government.

3.5 CONNECTIONS TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made in such manner that the finished work shall conform as nearly as practicable to the applicable requirements for new manholes.

3.6 ACCEPTANCE

Sections of the sewer found defective in material, alignment, grade, or joints shall be corrected at no additional cost to the Government before acceptance.

-- End of Section --